


STEAG's large-scale battery systems a major contribution to security of supply for Europe

Christian Karalis, STEAG GmbH, Trading & Optimization – 6th November 2018

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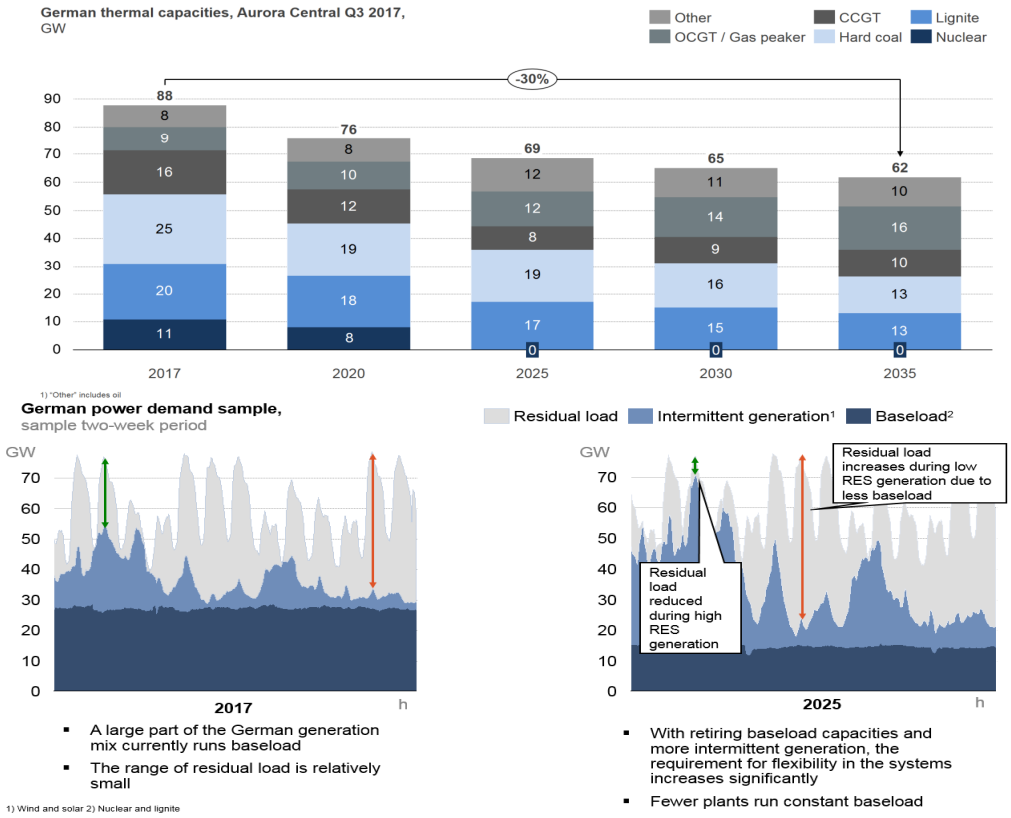
The “Energiewende“ leads to massive changes in the energy supply – in Germany and in other parts of Europe

Conventional generation plants in transition

- Currently: the backbone of reliable energy supply
- But: sharp increase of flexibility requirements and more shut-downs to be expected

Renewables as basis for the “Energiewende“

- Already today heavily unsteady wind and PV generation (feed-in priority along with uncertainty of forecast)
- Further addition will intensify this effect



Quelle: Aurora Energy Research (alle Abb., Oktober 2017)

Storage systems are in the context of the "Energiewende" in particular in ensuring grid stability and system security of special and rapidly growing importance

STEAG's battery systems have proven their technical and economical value after more than a year of commercial operation

- STEAG project with roots in its **own R&D** department
- Fully commercial project **without any subsidies**
- Battery systems are providing **primary control reserve** power (PCR) to TSOs
- Investment decision in 6 large-scale battery systems and contract closing with Nidec ASI in October 2015
- Project has been realized **in time – in quality – in budget**
- Official commissioning of all systems in November 2016
- Award as **reference project** of the **KlimaExpo.NRW**
- All 6 large-scale battery systems are marketed since beginning of December 2016
- **High success rate of bids** in the weekly TSO-tender process **> 97%**
- **Exceptional performance** of Battery Systems:
  - Very high load change rate (<5 MW/s)
  - max. deviation: 12 kW at 15.000 kW in the stationary state
  - Very good **technical availability** approx. **98%** (including maintenance)

The large-scale battery systems of STEAG are one of the worldwide largest battery storage projects

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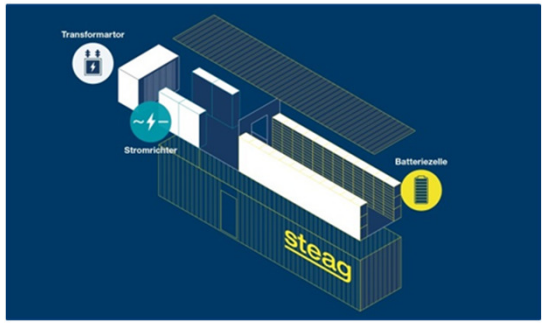
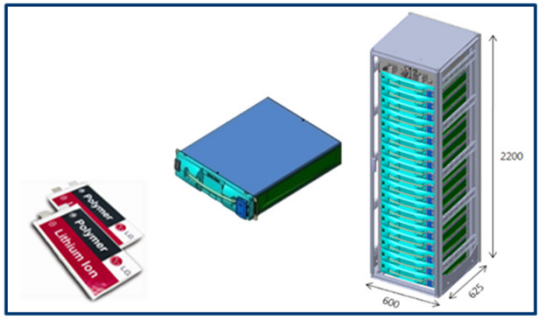
- 6 large-scale battery systems with 15 MW each and with a total area of around 1500 m²
- Fully automated and no additional personnel expenses
- Use of established infrastructure (synergy advantages)
- Use of the established lithium-ion technolog.
- Container solution including the option of an alternative usage (“relocation“)
- Configuration of large-scale battery systems
  - 10 battery containers with 1.5 MW + 5 transformers
  - 1 control container
  - Capacity of the battery systems (>120 MWh in total)
- Size of the container
  - Length: approx. 12.8m
  - Width: approx. 2.6m
  - Height: approx. 2.8m





Contribution of STEAG's battery systems to security of supply
Example 29th October 2017, 2^{15} – 3^{15} am, Herne

Tag Name	Description	Number	Server	Color	Units	Minimum	Maximum	IO Address	Time Offset	Source Tag	Source Ser...	Value at X1	Value at X2
N0CRU10FE001XQ009.Mes	[N0SOCMgt_ORI_PSOCSchedule] SOC management SOC Management Active pow...	1	10.193.1...		None	-4000.0...	4000.000	\\HERNE_HIST\InSQL...	0:00:00.000			0.000	0.000
N0CRU10FE004XQ005.Mes	[N0FreqMon_ORI_FreqMeas] Frequency monitoring Frequency measurement	3	10.193.1...		None	49.850	50.150	\\HERNE_HIST\InSQL...	0:00:00.000			50.003	50.016
N0CRU10EN018.Mes	[N0PhaseDisp_ORI_SOC] Phase dispacher General state of charge value	4	10.193.1...		None	30.000	70.000	\\HERNE_HIST\InSQL...	0:00:00.000			53.425	63.000
N0CRU10FE001XQ008.Mes	[N0SOCMgt_ORI_AutoPStp] SOC management Active power setpoint from automatic ...	5	10.193.1...		None	-5000.0...	5000.000	\\HERNE_HIST\InSQL...	0:00:00.000			1900.000	4750.000
N0CRU10FE001XQ005.Mes	[N0PPRLMgt_ORI_PStpLim] Primary frequency control Active power setpoint after limi...	6	10.193.1...		None	-15000....	15000....	\\HERNE_HIST\InSQL...	0:00:00.000			-269.853	-1199.920

Alert state when switching to winter time. Frequency deviation over ± 50 mHz for more than 15 min, in the peak up to 100 mHz. Exclusively negative primary control power over the double hour.

Contribution of STEAG's battery systems to security of supply
Example 15th October 2018, 6^{08} – 7^{00} pm, Herne

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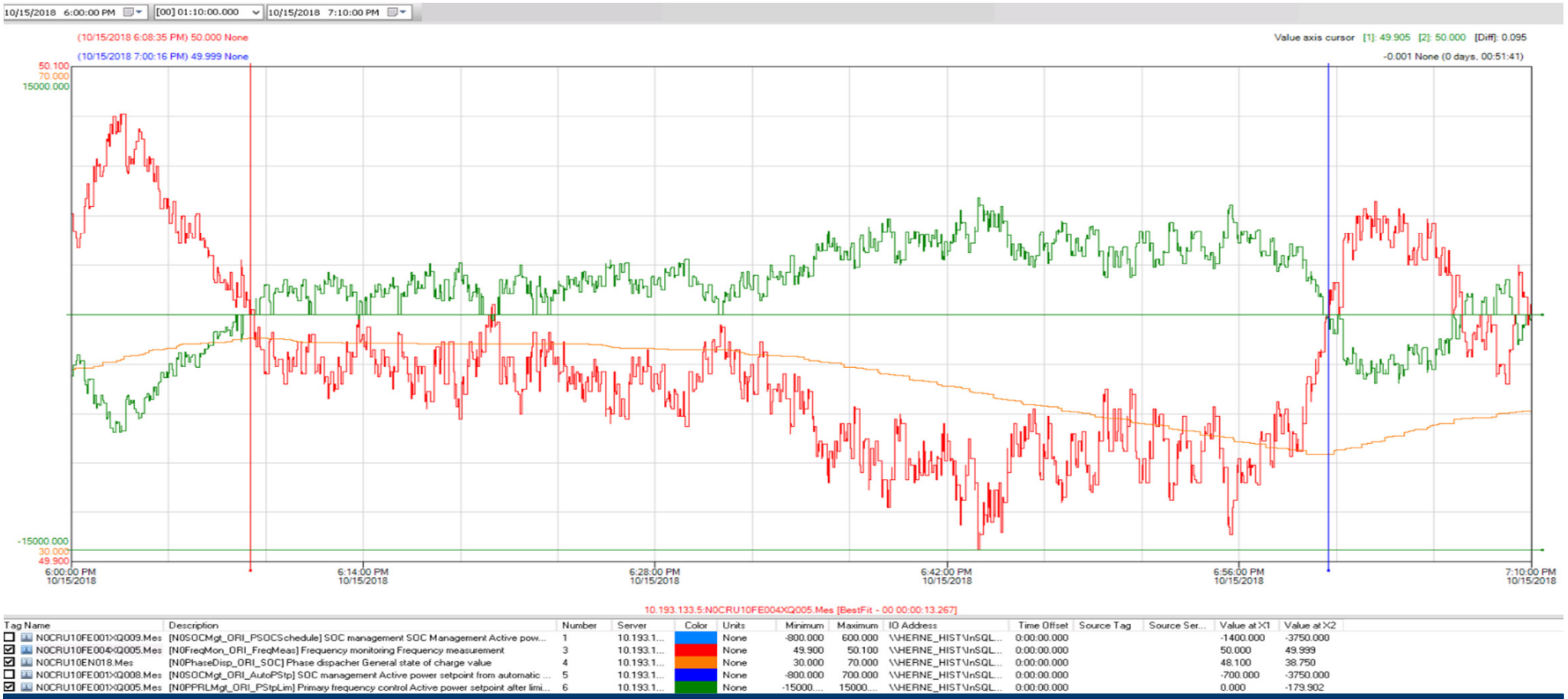

Tag Name	Description	Number	Server	Color	Units	Minimum	Maximum	IO Address	Time Offset	Source Tag	Source Ser...	Value at X1	Value at X2
☐ N0CRU10FE001XQ009.Mes	[N0SOCMgt_ORI_PSOCSchedule] SOC management SOC Management Active pow...	1	10.193.1...		None	-800.000	600.000	\\HERNE_HIST\InSQL...	0:00:00.000			-1400.000	-3750.000
☑ N0CRU10FE004XQ005.Mes	[N0FreqMon_ORI_FreqMeas] Frequency monitoring Frequency measurement	3	10.193.1...		None	49.900	50.100	\\HERNE_HIST\InSQL...	0:00:00.000			50.000	49.999
☑ N0CRU10EN018.Mes	[N0PhaseDisp_ORI_SOC] Phase dispacher General state of charge value	4	10.193.1...		None	30.000	70.000	\\HERNE_HIST\InSQL...	0:00:00.000			48.100	38.750
☐ N0CRU10FE001XQ008.Mes	[N0SOCMgt_ORI_AutoPStp] SOC management Active power setpoint from automatic ...	5	10.193.1...		None	-800.000	700.000	\\HERNE_HIST\InSQL...	0:00:00.000			-700.000	-3750.000
☑ N0CRU10FE001XQ005.Mes	[N0PPRLMgt_ORI_PStpLim] Primary frequency control Active power setpoint after limi...	6	10.193.1...		None	-15000....	15000....	\\HERNE_HIST\InSQL...	0:00:00.000			0.000	-179.902

Alert State on a weekday. Frequency deviation over ± 50 mHz for more than 15 min, in the peak up to 100 mHz. Exclusively positive primary control power over nearly one hour.

Frequency control is only a first application for batteries! What is the way forward?

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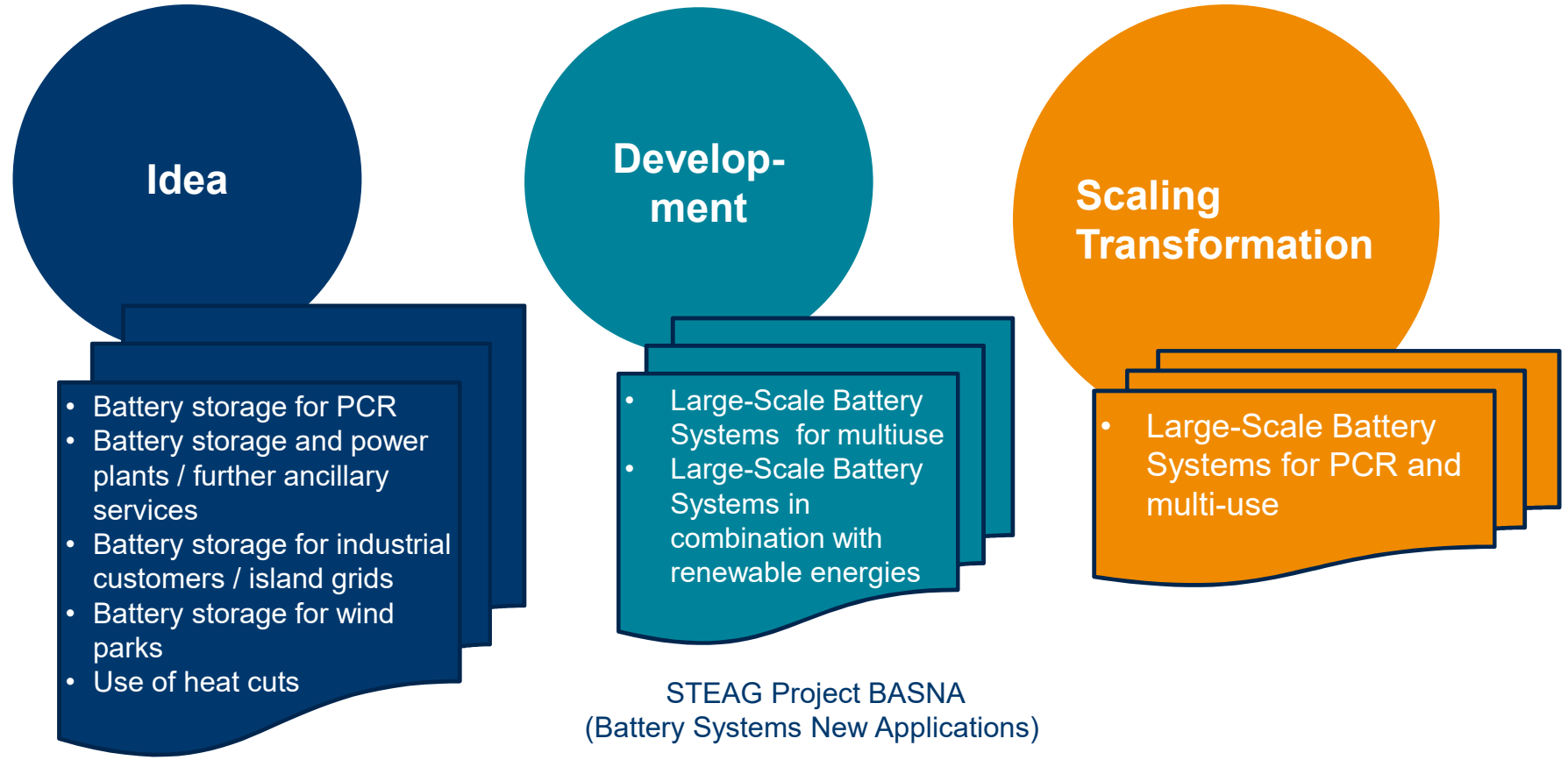

STEAG Project BASNA
(Battery Systems New Applications)

But: Innovations need smart and reliable rules and markets!

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Crucial is:

1. **Securing the unbundling:** further grid expansion and clear market roles
   As basis for competition also in ancillary services. Load management is not a task of the grid operators!
2. **Same, continuous rules** for all market participants, also for providing control reserve in Europe.
3. **Reward forecasting accuracy, ensure value of flexibility:** Increase requirements for balancing, no renewable compensation at negative prices and without the involvement of the grid operator
4. Considering No.1-3 a reasonable sector coupling can be stimulated according to (system)-requirements, which make economic sense and the “Energiewende” can lead to success.

There are many useful applications for battery systems and other storage devices.
Improving the technical potential requires intelligent, competitive rules.

We are available to answer any questions and / or project suggestions with pleasure

Your contact

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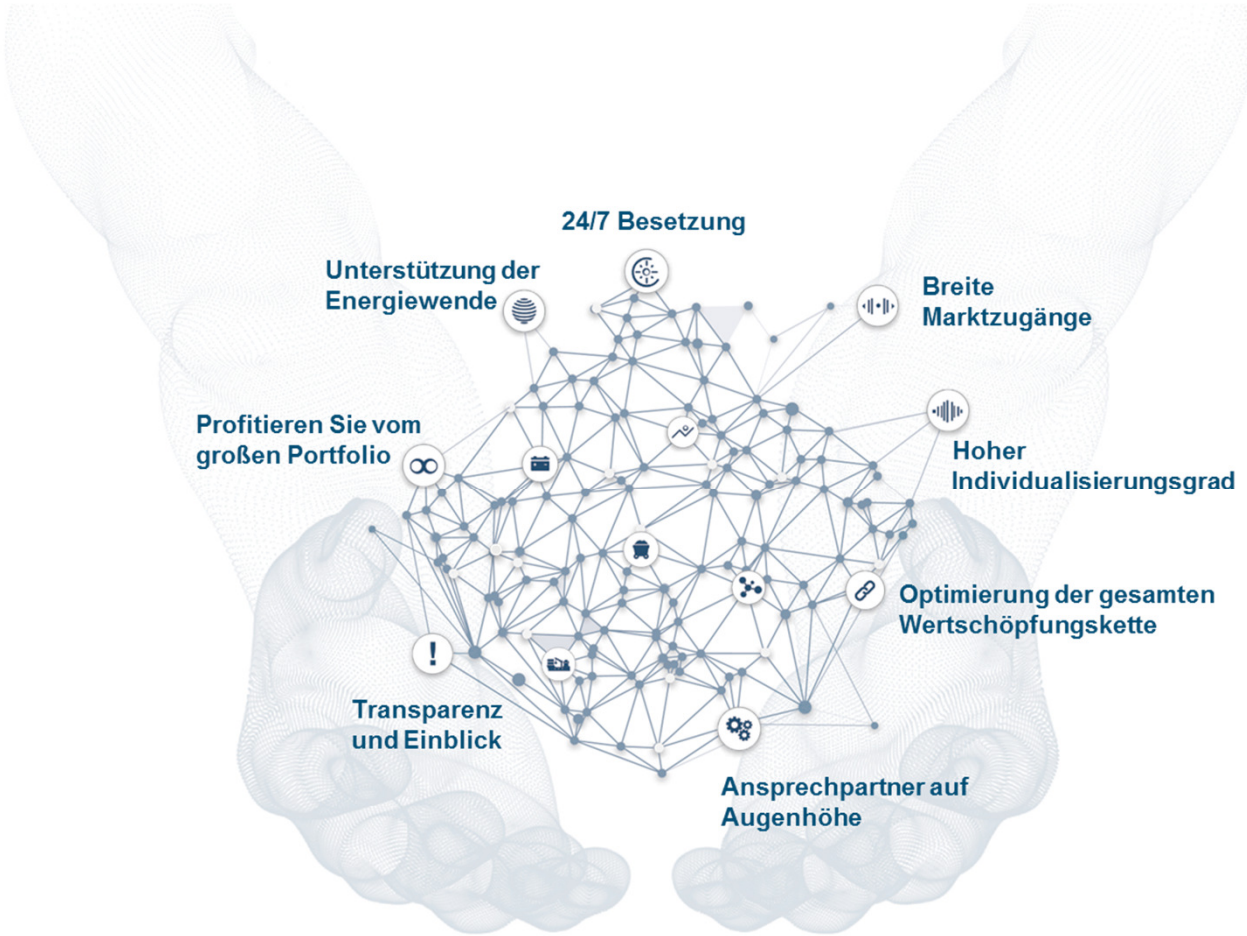


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30 min.-criterion for all PCR providers
An essential requirement to ensure grid stability & system security

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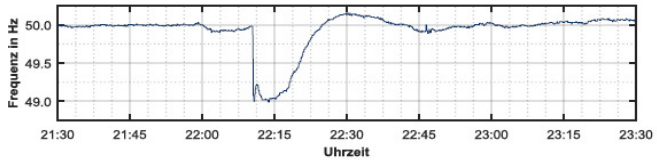
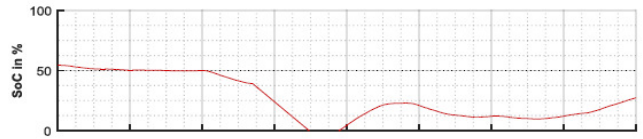
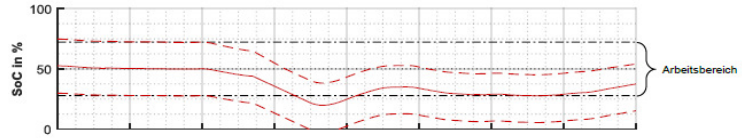
STÖRFALL EMS – 04.11.2006



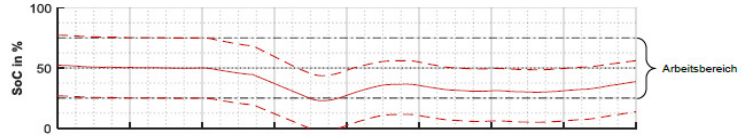
15 MW / 7,5 MWh → 15 Min. können nur aus dem mittleren Ladezustand erbracht werden



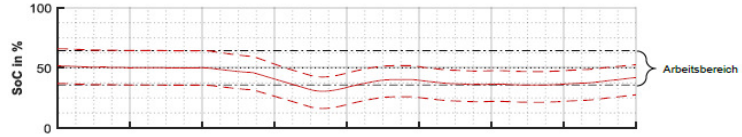
15 MW / 13,5 MWh → 15 Min. können aus dem gesamten Arbeitsbereich erbracht werden



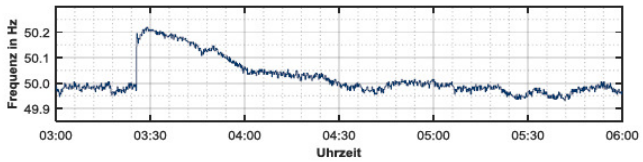
15 MW / 15 MWh → 15 Min. können aus dem gesamten Arbeitsbereich erbracht werden
→ 30 Min. können nur aus dem mittleren Ladezustand erbracht werden



15 MW / 21 MWh → 30 Min. können aus dem gesamten Arbeitsbereich erbracht werden!



STÖRFALL ITALIEN – 28.09.2003



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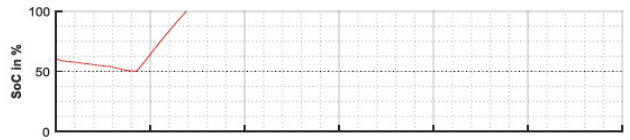

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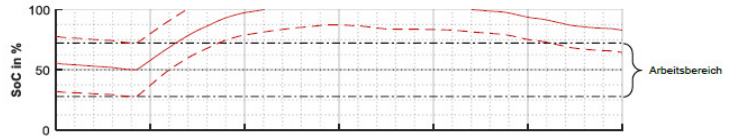

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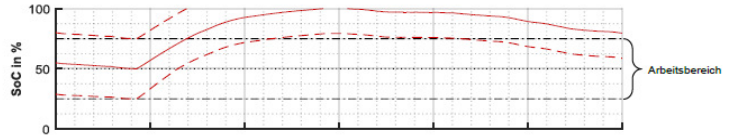

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